

ASSOCIATIONS BETWEEN CHILD AND PARENT KNOWLEDGE OF ADDED SUGAR  
RECOMMENDATIONS AND ADDED SUGAR INTAKE IN MULTIETHNIC  
ELEMENTARY AGED CHILDREN

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## ABSTRACT

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**Title:** Associations between child and parent knowledge of added sugar recommendations and added sugar intake in multiethnic elementary aged children

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**Background:** Due to the adverse health effects of added sugar consumption, the 2015-2020 Dietary Guidelines for Americans (DGA) encourages reduced intake of added sugars. While education is a key component of the DGA, no research has been conducted to study if parent and child knowledge of recommendations for added sugar is associated with decreased intake in children. The aim of this study was to determine the impact of parent and child knowledge of added sugar recommendations on added sugar and sugar-sweetened beverage (SSB) intake in low-income primarily Hispanic 3rd to 5th grade students.

**Methods:** This study examines baseline data from TX Sprouts, a 1-year cooking, gardening, and nutrition clustered, randomized control trial. Parents and children completed a survey to assess knowledge of added sugar recommendations and SSB. Children completed two, 24-hour dietary recalls to assess average child intake of added sugars. Regression models were used to assess associations between parent and child knowledge of added sugar recommendations and identification of SSB with added sugar and SSB intake.

**Results:** This analyses includes 592 children with complete child surveys, parent surveys, and dietary recall data. Approximately 60% of the sample was Hispanic, 23% was non-Hispanic white, and 11% was African American, and 54.4% was female. Only 38.3% of children were able to identify the correct recommendation for added sugar intake compared to 45.6% of parents. Children who correctly identified the added sugar recommendation consumed lower amounts of added sugar compared to children who did not correctly identify the recommendation ( $36.4 \pm 2.1$  vs.  $40.5 \pm 1.8$  grams,  $p < 0.03$ ). Parent knowledge of added sugar recommendations was not associated with child added sugar intake. Neither knowledge of added sugar recommendations nor ability to identify low sugar beverages was associated with child SSB consumption.

**Conclusions:** These findings suggest that child knowledge of added sugar guidelines is associated with lower intake of added sugar. Nutrition education in children should focus on increasing knowledge of national guidelines and recommendations to improve dietary intake and overall health.

**Keywords:** Added sugars; nutrition knowledge; sugar-sweetened beverages; child; parent

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## INTRODUCTION

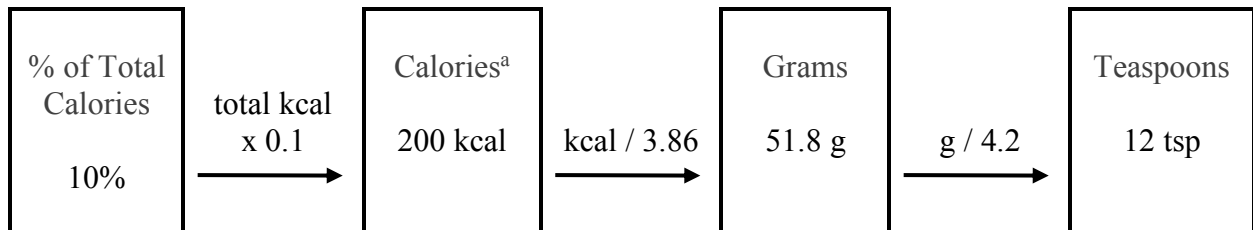
The average 4-13 year old child in the United States (U.S.) consumes over 150% the recommended amount of added sugar per day, a practice which increases the child's risk of developing adverse and chronic health conditions later in life.<sup>1,2</sup> Added sugars are defined as any sugar, syrup, or concentrate added to a food or beverage during processing or preparation.<sup>3,4</sup> Studies consistently show a link between added sugar intake and unfavorable body mass index (BMI).<sup>5</sup> Added sugar intake through sugar-sweetened beverage (SSB) is highly associated with increased adiposity in children.<sup>6</sup> One study on 4<sup>th</sup> grade students showed that each additional serving of soda (serv/day) is associated with a 0.11 kg/m<sup>2</sup> increase in BMI.<sup>7</sup> Added sugar intake is also associated with type 2 diabetes.<sup>8</sup> Adolescents who are overweight or obese and over-consume added sugar are at high risk of developing insulin resistance, which may lead to development of diabetes.<sup>9</sup> Research has also found that added sugar intake is significantly associated with cardiovascular disease (CVD) and CVD risk factors, such as elevated serum triglycerides and blood pressure.<sup>10-12</sup> SSB intake is associated with decreased HDL cholesterol in children, with some evidence linking SSB consumption to increased LDL cholesterol.<sup>13,14</sup> These markers are speculated to be an early sign of diet-induced dyslipidemia, as SSB consumption has been linked to dyslipidemia in individuals of adolescent age.<sup>9,13</sup> Elevated systolic blood pressure has also been associated with SSB consumption in adolescents and serves as another warning sign that added sugar consumption in childhood may contribute to CVD development later in life.<sup>15</sup>

Due to the adverse health effects of added sugar consumption, the Dietary Guidelines for Americans (DGA) has encouraged reduction of added sugar since its first publication in 1980.<sup>16</sup> The 2015 DGA was the first to publicize a quantifiable guideline for added sugar alone, recommending that <10% daily calories come from added sugar.<sup>17</sup> The history of added sugar guidelines in the U.S. is outlined in **Table 1**. For a 2,000 calorie diet, 10% of calories is equivalent to about 50 grams or 12 teaspoons of added sugar.<sup>18,19</sup> See **Figure 1** for conversions.

**Table 1.** DGA Evolution of Added Sugar Recommendation

1980	1985	1990	1995	2000	2005	2010	2015
Avoid too much sugar		Choose a diet moderate in sugars			Choose and prepare foods and beverages with little added sugars or caloric sweeteners	Reduce intake of added sugars	Consume <10% of calories from added sugar

<sup>a</sup>Data from the Center for Science in the Public Interest<sup>16</sup>



**Figure 1.** Conversions between calories, grams, and teaspoons of added sugars

<sup>a</sup>Based on a 2000 kcal diet

Current recommendations for added sugar intake are relatively consistent across sources. The American Academy of Pediatrics and American Diabetes Association have released statements in support U.S. 2015-2020 Guidelines.<sup>20,21</sup> The World Health Organization also recommends that added sugar comprise <10% of daily calories but suggests that individuals should consume <5% of calories from added sugar for additional benefits.<sup>22</sup> The American Heart Association (AHA) is the only organization found to differ in guidelines, recommending that women consume <100 calories, men consume <150 calories, and children consume <100 calories from added sugar per day.<sup>23,24</sup> The AHA advises that children under 2 years old should avoid added sugar completely.<sup>24</sup> An overview of added sugar recommendations for children can be found in **Table 2**.

**Table 2.** Recommended Daily Intake of Added Sugar for Children

	% of Total Calories	Calories (kcal)	Grams (g)	Teaspoons (tsp)
<b>2015 DGA</b> <sup>a</sup>	10%	200 kcal	50 g	12 tsp
<b>WHO</b> <sup>b</sup>	10%	200 kcal	50 g	12 tsp
<b>AHA</b> <sup>c</sup>	5%	<100 kcal	25 g	6 tsp

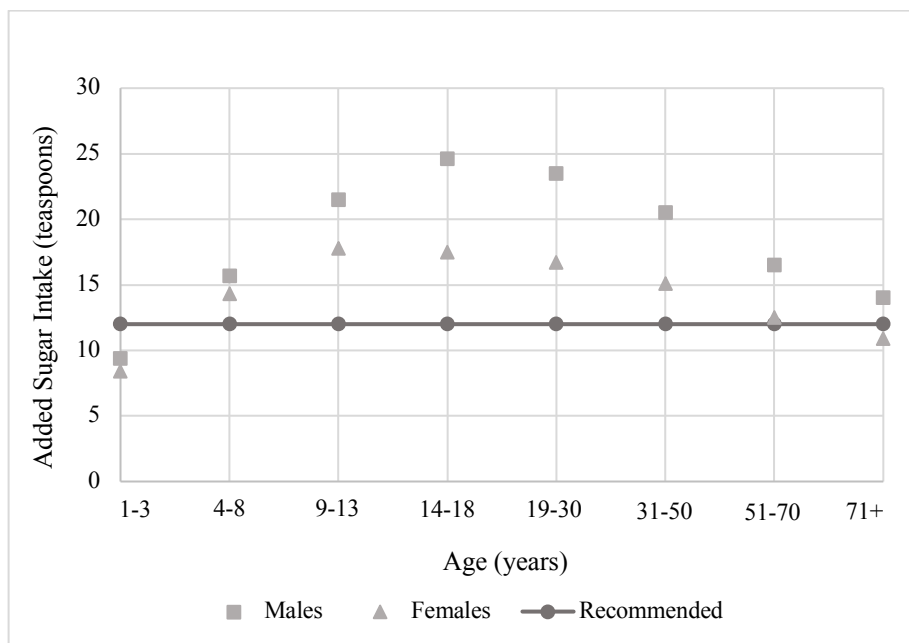
Abbreviations: kcal, kilocalorie; g, grams; tsp, teaspoons; DGA, Dietary Guidelines for Americans; WHO, World Health Organization; AHA, American Heart Association

<sup>a</sup> Data from the U.S. Department of Agriculture<sup>17</sup>

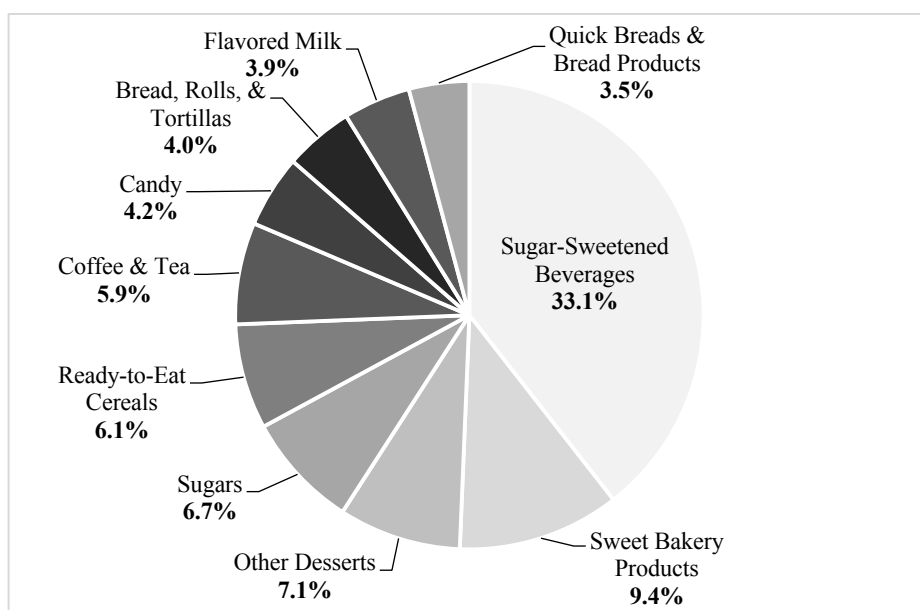
<sup>b</sup> Data from the World Health Organization<sup>22</sup>

<sup>c</sup> Data from the American Heart Association<sup>24</sup>

Despite these guidelines, the U.S. diet continues to have an excess of added sugar, with an average 13.4% of daily calories from added sugar for individuals above the age of 1 year.<sup>1,25</sup> Added sugar intake varies by population demographics, with non-Hispanic Blacks being less likely than Hispanics and as likely as non-Hispanic Whites to meet added sugar recommendations in individuals 2-19 years of age.<sup>18</sup> In children, added sugar intake does not vary by household income.<sup>18</sup> The diets of children ages 9-13 and 14-18 are the highest in added sugar across all age groups, averaging 17% of calories from added sugar (**Figure 2**).<sup>2,17</sup> In spite of the <50 grams of added sugar recommendation for a 2,000 calorie diet<sup>17</sup>, the 2013-2014 National Health and Nutrition Examination Survey (NHANES) reported that 67% of children ages 2-19 in the U.S. consumed diets that exceeded the added sugar recommendation.<sup>18</sup> Data from the 2009-2012 NHANES found that the median decile of 9-18 year old males and females in the U.S. consumed an average of 76.5-80.9 grams of added sugar per day (15.7-16.4% calories per day).<sup>26</sup> The highest decile consumed ≥110.9 grams per day (≥20% calories per day).<sup>26</sup> SSBs are the most common sources of added sugar for the median decile of children and adolescents 9-18 years of age, with 33.1% of dietary added sugar coming from soda, fruit drinks, energy, and sports drinks.<sup>26</sup> In the highest decile of added sugar consumers, SSBs contributed >50% of daily total added sugar intake.<sup>26</sup> The top ten sources of added sugar for 9-18 year old individuals in the median decile of added sugar intake is shown in **Figure 3**.<sup>26</sup>



**Figure 2.** Added sugar intake for different age groups in the United States stratified by sex (NHANES 2007-2010)<sup>2</sup>



**Figure 3.** Top ten sources of added sugars for 9-18 year old individuals in the median decile of added sugar intake (NHANES 2009-2012)<sup>26</sup>

The goal of the dietary guidelines is to reduce added sugar intake by increasing public knowledge about added sugars. Previous research has shown that the use of MyPlate or MyPyramid is associated with diets that are lower in calories, sodium, added sugar, and cholesterol

as well as higher in whole grains and vegetables.<sup>27</sup> Even without these tools, simple nutritional knowledge is associated with healthier diets in adults.<sup>28,29</sup> In children, both parent and child knowledge of nutrition topics have been shown to be associated with diet quality.<sup>30</sup> The strength at which child knowledge influences diet depends largely on the age and independence of the child. Parent knowledge appears to be highly influential on the diet of the child.<sup>31-33</sup> Younger children are more influenced by their parents' dietary knowledge than older children.<sup>30</sup> However, child nutrition knowledge is predicted by parent nutrition knowledge, so parent knowledge maintains indirect influence on children, even as they grow older.<sup>34</sup> Yet, while education is a key goal of the DGA, no research has been conducted to study if knowledge of the guidelines for added sugar is associated with decreased intake in children.

The aim of this study is to determine the relationship between parent and child knowledge of added sugar guidelines and added sugar intake in a sample of 3<sup>rd</sup> to 5<sup>th</sup> grade students. It is hypothesized that increased parent and child knowledge of guidelines will be associated with decreased child added sugar intake. Findings of this study will inform efforts to educate the public about added sugar in order to maximize the effectiveness of outreach.



## METHODOLOGY

### *Description of Study*

This analysis used cross-sectional data from a parent study, TX Sprouts, that assessed the impact of a 1-year school based gardening, cooking, and nutrition program. The study targeted over 3,000 3rd-5th grade students and their families from 16 elementary schools in the Austin area. Schools were randomized into one of three waves of data collection occurring between August 2016 and October 2018. Schools included in the trial had to meet the following inclusion criteria: 1) high proportion of Hispanic children (>50%); 2) high proportion of children participating in the free and reduced lunch (FRL) program (>50%); and 3) location within 60 miles of The University of Texas at Austin (UT-Austin) campus. Full methods of the ongoing TX Sprouts intervention will be published elsewhere. The trial is registered at ClinicalTrials.gov (NCT02668744).

### *Recruitment*

All 3rd-5th grade students and parents at the recruited schools were contacted to participate via tables at “Back to School” and “Meet the Teacher” evenings events, flyers sent home with students, and teachers making class announcements.

### *Institutional Review Board*

Written informed consent was obtained from all parents, and assent from each student was obtained. Both consent and assent was required for inclusion in the study. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Institutional Review Boards of UT-Austin and the individual school district review boards.

### *Data Collection*

At baseline, students completed a 12-page questionnaire packets during the school day at their respective schools as part of a larger data collection effort for TX Sprouts. Questionnaires included items on demographics<sup>35</sup>, food and meal choice behaviors<sup>36</sup>, fruit and vegetable preferences<sup>37</sup>, beverage intake<sup>38</sup>, cooking and gardening attitude and self-efficacy<sup>39,40</sup>, and nutrition knowledge<sup>39</sup>. Questionnaires were provided in both English and Spanish, and bilingual interpreters were available to assist students if needed.

At baseline, parents completed a 12-page questionnaire packet. Questionnaires were completed either at “Back to School” or “Meet the Teacher” evenings events or were sent home with student, completed by a parent, and returned to school with the student. Questionnaires included items on demographics<sup>35</sup>, food and meal choice behaviors<sup>41</sup>, fruit and vegetable preferences<sup>37</sup>, cooking and gardening attitude and self-efficacy<sup>39,40</sup>, and nutrition knowledge<sup>39</sup>. Questionnaires were provided in both English and Spanish. Parents received a \$15 gift card to a local grocery store as an incentive for completing the questionnaire.

### *Nutrition Knowledge Items*

This analysis only examined items measuring parent and student knowledge of nutritional guidelines for added sugar and ability to identify low sugar beverages. Both children and parents were asked to identify the amount of added sugar that should be consumed in a day. Table 3 displays questionnaire items and response options for both children and parents.

Parent and child questions assessing knowledge of added sugar guidelines and ability to identify the lowest sugar beverage

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**How much ADDED SUGAR should we eat daily?**

- ☐ Less than 50 grams <sup>a</sup>
- ☐ Less than 75 grams
- ☐ Less than 100 grams
- ☐ 100-200 grams
- ☐ I don't know <sup>b</sup>

**Which of the following drinks has the LOWEST amount of sugar?**

- ☐ Soda
  - ☐ Gatorade
  - ☐ Orange juice
  - ☐ Milk <sup>c</sup>
  - ☐ Water with lemon <sup>a</sup>
  - ☐ I don't know <sup>b</sup>
- 

<sup>a</sup> Correct answer

<sup>b</sup> "I don't know" was considered an incorrect answer

<sup>c</sup> Option provided only in parent questionnaire

### *24-Hour Dietary Recalls*

All participants completed two 24-hour dietary recalls which were collected via telephone by trained staff and supervised by a Registered Dietitian Nutritionist using Nutrition Data System for Research, a computer-based software application that facilitates the collection of recalls in a standardized fashion<sup>42</sup>. Dietary intake data gathered by interview was governed by a multiple-pass interview approach<sup>43</sup>. Five distinct passes provided multiple opportunities for the participant to recall food intake. Students took approximately 20-30 minutes to complete each recall. A Food Amounts Booklet was distributed to students and used to estimate serving sizes during recalls. Menus and portion sizes were obtained from school food services to aid in collecting recalls. Parents and/or guardians of students were allowed to assist with recalls as needed. Assistance included recalling food items consumed and estimating serving sizes. Students received a \$10 incentive for completing the recalls. Quality assurance was performed on all dietary recall data by additional trained research staff.

### *Statistical Analyses*

A multiple linear regression was run to assess associations between child and parent knowledge of added sugar recommendations and intake of added sugar. Next, a binomial logistic regression model was used to assess the likelihood of children meeting the added sugar recommendation in the dietary intake based on child and parent knowledge of the added sugar recommendations. Lastly, a second multiple linear regression was used to assess the associations between child and parent knowledge of both added sugar recommendations and identification of SSB on intake of SSB. All regression models were adjusted for covariates identified *a priori* including child ethnicity, sex, and age and average daily energy (kilocalorie) intake and parent ethnicity and education. All data were analyzed using SPSS Statistics for Macintosh, Version 24.0 (IBM Corp, Armonk, NY), and an alpha level of  $p = 0.05$  was used for significance.

## RESULTS

### *Study Sample*

Of the 4239 eligible students at the 16 elementary schools, 3,303 children (78%) consented to be in the TX Sprouts study. Out of those consented children, 3,137 (94%) completed baseline clinical measures and were in the clinical trial. Two, 24-hour dietary recalls were collected on a randomized subsample of 738 (24%) children in the clinical trial. Of those with dietary recall data, 712 children also had parent data (96%). Cases were then excluded if data were missing for independent or dependent variables or covariates included in regression models. The final analytic sample was 592 child-parent dyads.

The parent sample was predominantly female (88%). A child's mother or father was the primary questionnaire respondent (97%); other respondents were grandparents (2%) or other guardians (1%). The parent sample was primarily Hispanic (59.8%). Other races comprising the sample were non-Hispanic white (27.0%), non-Hispanic black (9.3%) and other (3.9%). The child sample was 54.4% female, and ages of children ranged from 7 to 13 with a mean age of  $9.2 \pm 0.9$  years. **Table 4** provides further detail on the sample demographics. Average added sugar via 24-hour dietary recalls was  $38.43 \pm 25.88$  grams and on average children consumed  $0.74 \pm 0.87$  servings of SSB.

**Table 4.** Demographics of child and parent sample (n=592)

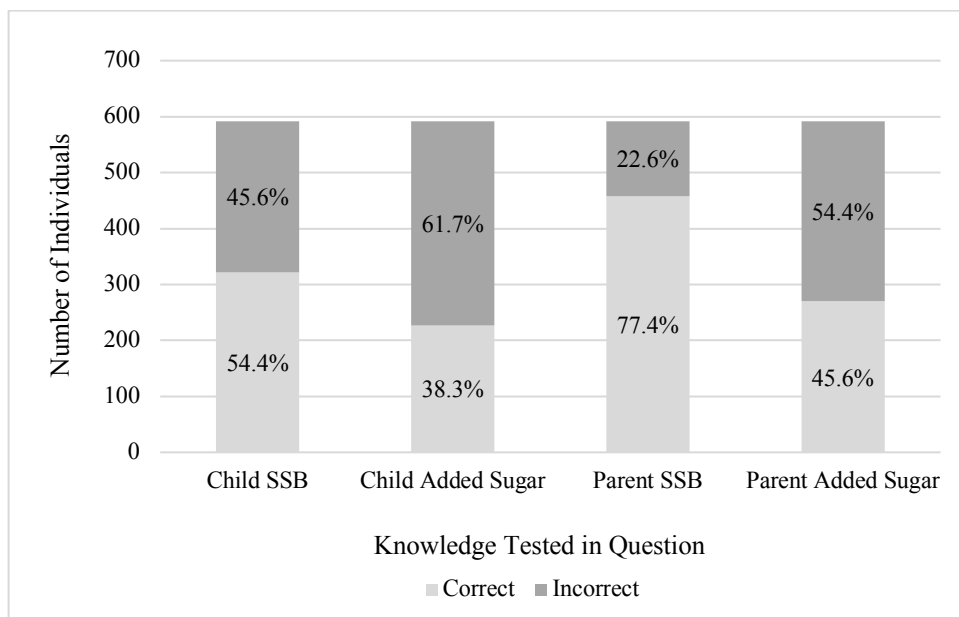
	n(%) or mean $\pm$ SD
<b>Parent Demographics</b>	
Sex, Female	519 (87.7)
Age (y)	37.27 $\pm$ 6.60
Ethnicity/Race	
Non-Hispanic White	160 (27.0)
Hispanic or Latino	354 (59.8)
Black or African American	55 (9.3)
Other	23 (3.9)
Birthplace	
Born in the U.S.	401 (67.7)
Born outside the U.S.	189 (31.9)
<b>Child Demographics</b>	
Sex, Female	322 (54.4)
Age (y)	9.23 $\pm$ 0.91
Ethnicity/Race	
Non-Hispanic White	136 (23.0)
Hispanic or Latino	354 (59.8)
Black or African American	65 (11.0)
Other	37 (6.3)

Grade	
3rd grade	160 (27.0)
4th grade	229 (38.7)
5th grade	203 (34.3)
<b>Parent Education</b>	
No high school	87 (14.7)
Some high school	52 (8.8)
High school graduate / GED	132 (22.3)
Some college or vocational school	171 (28.9)
College graduate	113 (19.1)
Graduate or professional training	37 (6.3)
<b>Primary Language Spoken at Home</b>	
English	340 (57.4)
Spanish	141 (23.8)
Both English and Spanish	99 (16.7)
Other	5 (0.8)
<b>Government Benefits</b>	
Child receiving free/reduced lunch	379 (64.0)
SNAP	117 (29.9)
<b>Child Dietary Measures</b>	
Added Sugar (g/day)	38.43 ±25.88
Sugar-Sweetened Beverage (serving/day)	0.74 ±0.87

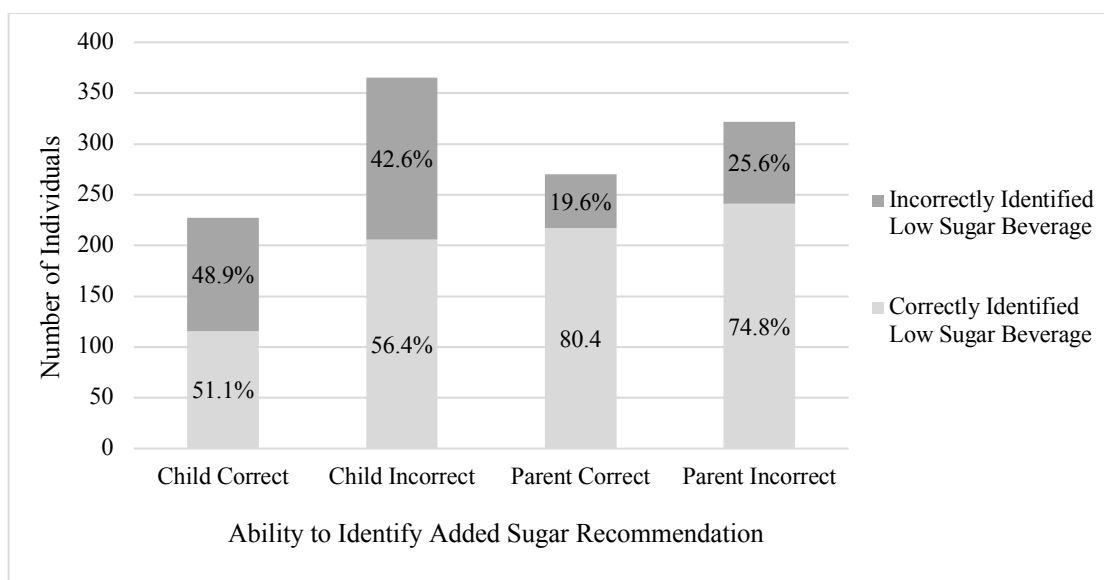
### *Knowledge of Added Sugar Recommendations and Identification of Low Sugar Beverages*

Of the 592 children, 38.3% correctly identified the added sugar recommendation of <50g per day and 54.4% correctly identified the lowest sugar beverage (**Figure 4**). Children who recognized the added sugar recommendation were able to correctly identify the lowest sugar beverage 51.1% of the time. Children who did not identify the added sugar recommendation were able to select the lowest sugar beverage 56.4% of the time (**Figure 5**). **Table 5** compares parent versus child knowledge of added sugar recommendations, segregated by whether the child's diet exceeded the <50g added sugar recommendation.

Parents correctly identified the added sugar recommendation of <50g per day 45.6% of the time and selected the lowest sugar beverage 77.4% of the time (**Figure 4**). Of the parents who correctly identified the added sugar recommendation, 80.4% were able to select the lowest sugar beverage, while 74.8% of parents who did not identify the recommendation were able to identify the lowest sugar beverage. **Figure 5** shows parent attempts to identify the lowest sugar beverage, stratified by their ability to recognize the added sugar recommendation.



**Figure 4.** Percentages of parents and children who correctly/incorrectly selected the lowest sugar beverage and correctly/incorrectly identified the U.S. added sugar recommendation



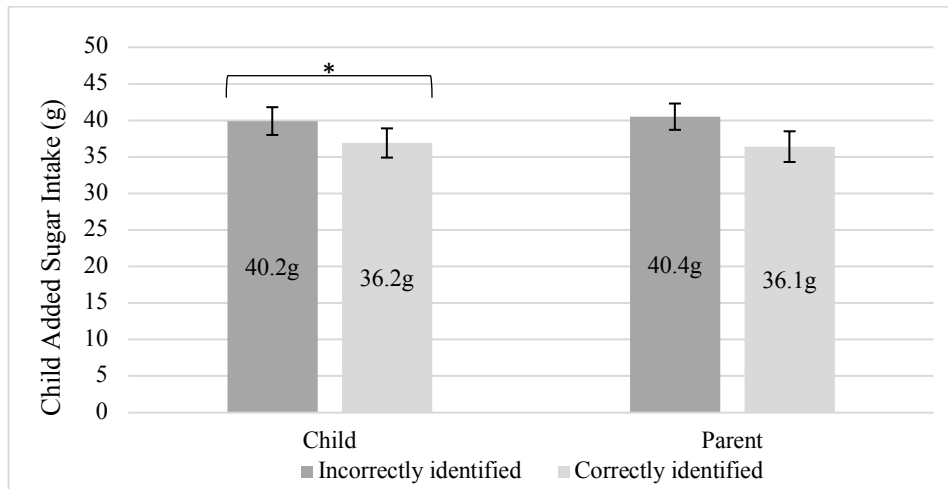
**Figure 5.** Percentages of parents and children who correctly/incorrectly selected the lowest sugar beverage, stratified by ability to identify the <50g added sugar recommendation

**Table 5.** Child vs. parent knowledge of added sugar recommendations stratified if the child met added sugar recommendations in dietary intake

			<b>Parent Identification of Added Sugar Recommendation</b>		
			Correct	Incorrect	Total
<b>Meets &lt;50g Added Sugar Recommendation</b>	<b>Child Identification of Added Sugar Recommendation</b>	Correct	87	91	178
		Incorrect	110	147	257
	<b>Total</b>		197	238	435
<b>Does not meet &lt;50g Added Sugar Recommendation</b>	<b>Child Identification of Added Sugar Recommendation</b>	Correct	20	29	49
		Incorrect	53	55	108
	<b>Total</b>		73	84	157
<b>Total</b>	<b>Child Identification of Added Sugar Recommendation</b>	Correct	107	120	227
		Incorrect	163	202	365
	<b>Total</b>		270	322	592

### *Main Outcomes*

Children who were able to identify the <50g added sugar recommendation consumed significantly less added sugar than children who were not able to identify the recommendation ( $36.4 \pm 2.1$  vs.  $40.5 \pm 1.8$  grams;  $p=0.03$ ) (**Figure 6**). Parent knowledge of the recommendations was not associated with their child's intake of added sugar ( $p=0.13$ ). Neither child nor parent knowledge of the added sugar recommendations was associated with the likelihood of a child meeting the added sugar recommendation. Additionally, neither child nor parent knowledge of the added sugar recommendations nor identification of the lowest sugar beverage was associated with a child's average SSB intake.



**Figure 6.** Binomial logistic regression model assessing child added sugar intake, stratified by parent/child and ability to identify added sugar recommendation while controlling for child ethnicity, sex, and age and average daily energy (kilocalorie) intake, and parent ethnicity and education

\*  $p < 0.05$



## DISCUSSION

Added sugar intake is associated with increased BMI, insulin resistance, and cardiovascular risk factors in children and adolescents.<sup>6-15</sup> Due to the adverse health effects of added sugar consumption, the 2015 Dietary Guidelines for Americans recommends that <10% of daily calories come from added sugars.<sup>17</sup> This analysis was the first study to find that child knowledge of added sugar recommendations was significantly associated with decreased added sugar intake. Parent knowledge of recommendations, however, was not associated with child added sugar intake. Child and parent knowledge of added sugar recommendations and ability to identify low sugar beverages were not associated with child SSB intake.

Previous studies support the finding that child knowledge of added sugar recommendations is associated added sugar intake.<sup>27-30</sup> A search of the literature did not find any studies examining knowledge of added sugar guidelines and added sugar intake in children. However, prior studies have found nutrition knowledge to be associated with added sugar intake in adults<sup>27-29</sup> and other variables of dietary intake in children.<sup>30</sup> Schwartz and Vernarelli (2018) found that adults using MyPlate or MyPyramid, programs designed to educate individuals about the dietary guidelines, had significantly lower intake of added sugars compared to adults who did not use these resources.<sup>27</sup> These findings suggest that knowledge of added sugar recommendations is associated with added sugar intake in adults.<sup>27</sup> A study examining primary school children in Japan found that general nutrition knowledge was associated with increased vegetable intake in children 6-12 years of age.<sup>30</sup> These findings support the idea that child nutrition knowledge can influence child dietary intake.<sup>30</sup> Indeed, it seems logical that the individual consuming the food plays the most influential role in food choice, so it makes sense that child knowledge, over parent knowledge, was found to be significantly related to child intake.

Parent nutrition knowledge is considered to be a predictor of child nutrition knowledge<sup>34</sup>, so it was hypothesized that, if child added sugar knowledge was associated with added sugar intake, parent knowledge would also be associated with child intake. Studies examining parent nutrition knowledge have found significant associations with decreased SSB<sup>33</sup>, decreased cholesterol<sup>32</sup>, increased vegetable<sup>30,33</sup>, and increased fiber intake<sup>32</sup> in children. However, the results of this analysis did not show an association between parent added sugar knowledge and child added sugar intake. This finding was unexpected but not surprising. The influence of parent nutrition knowledge on child dietary intake appears to decrease as children grow older<sup>30,32</sup>, a trend which is a possible explanation for the results found by this analysis. Many studies have failed to show significant associations between parent nutrition knowledge and child dietary intake.<sup>32,33,44</sup> A study examining mothers who utilized daycares found that maternal nutrition knowledge was not associated with child consumption of high-sugar foods.<sup>44</sup> Other studies have also failed to show an association between parent knowledge and sweet consumption<sup>33</sup> and micronutrient intake<sup>32,33</sup> in children.

While SSBs contribute the majority of added sugar in the U.S. diet<sup>26</sup>, the lack of association between knowledge of added sugars, ability to identify low sugar beverages, and child SSB intake was not unexpected. Previous studies have failed to show an association between knowledge about SSBs and SSB intake.<sup>45-48</sup> Zahid *et al.* (2017) examined variables associated with child SSB intake and found that parent knowledge of SSB sugar content was not associated SSB consumption in children 9-12 years of age.<sup>45</sup> These findings suggest that parent knowledge of added sugar in SSBs

does not impact child SSB consumption.<sup>45</sup> Lundeen *et al.* (2018) examined knowledge of the health risks associated with SSB consumption, parent SSB intake, and adolescent SSB intake.<sup>46</sup> This study found that parent modeling of SSB consumption was significantly associated with adolescent SSB consumption, while knowledge of health risks was not associated with adolescent SSB intake.<sup>46</sup> Parent modeling<sup>46-48</sup> and availability of SSBs in the household<sup>45,47</sup>, rather than knowledge, consistently appear to show strong associations with SSB intake in children and adolescents.

Ultimately, the lack of association between knowledge and intake can be explained by the gap between knowledge and behavior. A multitude of factors, aside from knowledge, play a role in food choice.<sup>49,50</sup> Environmental and societal factors, like cultural preferences, food availability, religious practices, marketing, economic climate, and social practices, play an important role in food choice behavior.<sup>49-51</sup> Person-specific variables, like food preference and personality, also affect food choice and are frequently based in genetics.<sup>52</sup> Attitude towards nutrition recommendations<sup>33,50,53</sup> also strongly influences food choice. Romanos-Nanclares *et al.* (2018) found that parent attitude toward healthy eating was significantly associated with fruit, vegetable, legume, micronutrient intake in children, suggesting that attitude is an important factor in influencing food behavior.<sup>33</sup>

The demographics of the sample used in this analysis strengthens the value and utility of the results. This analysis used a sample of primarily low income and Hispanic individuals. The Hispanic population is one of the fastest growing ethnic minority groups in the United States.<sup>54</sup> Hispanic populations in the U.S. have higher prevalence of obesity, type II diabetes, and cardiovascular disease risk factors.<sup>55</sup> Similarly, low income populations are at higher risk of obesity, type II diabetes, and cardiovascular disease.<sup>56-58</sup> Considering the role of added sugar and SSB in development of these diseases, the study of added sugar in these populations has important implications to disease prevention. Another strength of this study was the use of multi-pass 24-hour dietary recalls to measure child intake of added sugars. This approach is regarded as the gold standard of self-reported dietary data collection. Therefore, the added sugar measurements used in this study are considered to be highly accurate.

The use of cross sectional data in this study prevents exploration of causality and restricts the analysis to only draw associations between variables. This causality will be examined at in the future using post-intervention data from TX Sprouts. An additional limitation of this analysis is the exclusion of a variety of variables known to effect behavior. Attitude<sup>33,50,53</sup>, food preferences<sup>52</sup>, parent dietary behavior<sup>46-48</sup>, and other factors that influence dietary intake were not included in this analysis but may have played a role in the results. Another potential limitation of this analysis is the phrasing of the question used to measure knowledge of added sugar recommendations. The answer choice “less than 50 grams” of added sugar per day was the lowest number provided as an option. Therefore, it is possible that selection of this answer reflected the belief that added sugar intake should be minimized, not actual knowledge of the DGA added sugar recommendation. However, despite this possibility, the majority of students still selected the incorrect answer or indicated that they did not know. These findings indicate a lack of knowledge about added sugar, suggesting the need for more education in these areas.

## **CONCLUSION**

This analysis examined relationships between parent and child knowledge of added sugar and SSBs as associated with child added sugar and SSB intake. Child knowledge of added sugar recommendations was significantly associated with child added sugar intake. Although the study did not find any variables to be significantly associated with SSB intake, the inability for many children to identify the lowest sugar beverage indicated that education in this area is lacking. These findings suggest the need for more interventions targeting nutrition knowledge in low income child populations. Future research should investigate effective teaching strategies to decrease added sugar and SSB intake in children.

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